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A Creel Census of Clearwater Lake, 1983-84.

By Leroux, D., 1988

Manitoba
Natural Resources
Fisheries

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ABSTRACT

Clearwater Lake provides a multiple use recreation area for The Pas area with sport fishing as a major attraction. Estimates of annual harvest were required to complement existing biological data collected in 1979 to derive an effective management plan for Clearwater Lake.

The annual harvest of lake trout and northern pike were estimated at 11,000 and 2,800 kg respectively. The fishery relies heavily on lake trout and current harvest levels are approaching the maximum sustainable yield. On a yearly basis, lodges accounted for 47% of the trout harvest and 74% of the pike harvest. Although cottage owners accounted for 18% of the harvest, the data indicates that a small proportion of the cottages accounted for this harvest. Winter angling has increased dramatically in recent times and now accounts for 23% of the annual harvest. Winter anglers are primarily local residents. Anglers on Clearwater Lake are consumptive in nature and release rates fall well below provincial averages.

Angling catch per unit effort is low in comparison to other lake trout fisheries and appears to have declined. CPUE values for Clearwater Lake averaged 0.25 fish per angler hour. Cottage owners exhibited the highest success rate at 0.55 fish per angler hour.

Weather has a strong influence on angler use during the open water season. The lake's open exposure makes it highly susceptible to wind. Winds approximating 15 - 20 km/hr usually keeps anglers off the lake.

As the demand for Clearwater fish resources will continue to increase, anglers must be prepared to accept a reduction in current harvest levels. It is recommended that angling opportunity be maintained or enhanced in meeting this objective.

ACKNOWLEDGEMENTS

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INTRODUCTION

Clearwater Lake, located 25 kilometers north of The Pas (Figure 1) is one of the principal recreation areas in The Pas region and maintains a high public profile. It is unique due to its depth and water clarity. The lake presently supports 349 private cottages, three lodges, three day use picnic areas as well as three campgrounds. Pioneer Bay, Campers' Cove and Hugo Bay campgrounds have 17, 40 and 105 unserviced lots respectively, howver the Hugo Bay site has been closed indefinitely since 1984. Although fishing is a major attraction, Clearwater Lake is also used as a summer and winter recreational area for various forms of outdoor activities.

Clearwater Lake provides a valuable source of lake trout (Salvelinus namaycush) eggs for the Fisheries Branch hatcheries. These eggs are used for stocking in Manitoba and have been traded with other provinces and states in return for eggs and fry of other species not available in the province.

Concern expressed by lodge and cottage owners and various organizations over the status of the lake trout population prompted a study in 1979 to assess the status of lake trout stocks in Clearwater Lake (Leroux, 1983). In order to derive an effective management plan for Clearwater Lake, estimates of harvest were needed to complement the biological data gathered in the 1979 study.

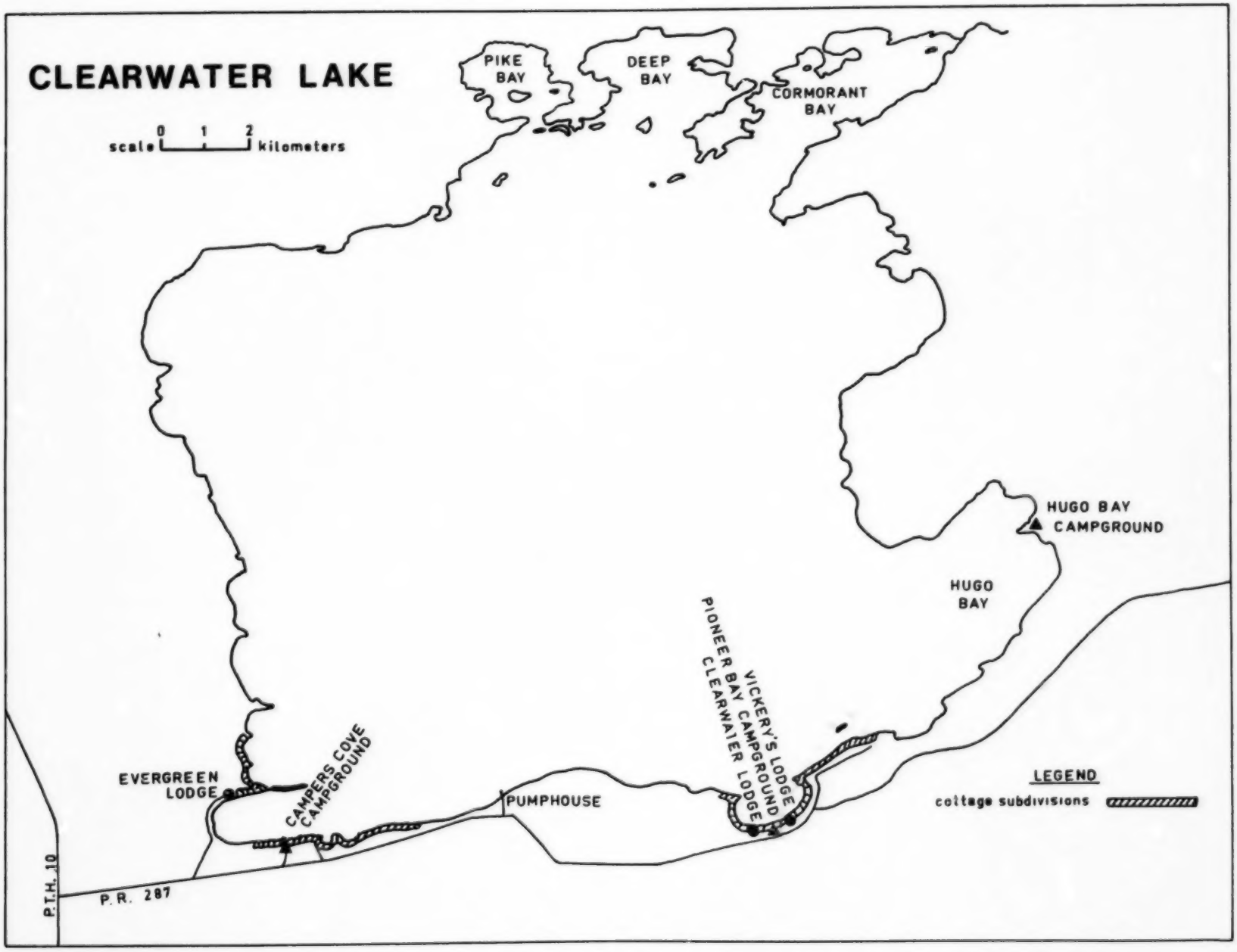


Figure 1. Map of Clearwater Lake indicating areas and locations pertaining to the creel census.

To obtain harvest estimates, a creel census study was initiated in 1983 to cover one entire angling season, both summer and winter. The objectives of the study were as follows:

1) determine present harvest rates of game fish on Clearwater Lake
2) classify the user groups and their respective proportion of the annual harvest
3) obtain biological data on the anglers' catch to determine which segment of the lake trout population is being harvested
4) suggest long term management goals and strategies based on the results of the creel census.

THE STUDY AREA

The following description is taken from Weir (1960) and Schlick (1978). Clearwater Lake (54°05'N, 101°00'W) is situated in a Silurian-Ordovician formation 25 kilometers north of The Pas, Manitoba (Figure 1). The surrounding natural vegetation is typically a northern coniferous forest type with predominantly black spruce. The lake is approximately 16 kilometers long and 16 kilometers wide with a surface area of 28,874 hectares. The west portion of the lake slopes gradually to a depth of 12 meters after which the lake bottom becomes irregular. In general, the eastern side of the lake slopes more rapidly to a depth of 12 meters. There are four distinct areas where the lake depth is in excess of 30 meters, with a maximum recorded depth of 38 meters. The mean depth of Clearwater Lake is 13.2 meters and it is considered an oligotrophic lake.

The Clearwater watershed is limited to an area of a few kilometers from the lake shoreline. A number of small, seasonally flowing streams enter Clearwater Lake on its west side, draining from the end moraine and muskeg to the west. Water flows out of Clearwater Lake into Cormorant Lake via a small river located on the northeast corner.

THE FISHERY

Presently, the main attraction for anglers in Clearwater Lake is the lake trout. Northern pike are caught incidentally in most areas of the lake, however angling specifically for this species does occur along the north shore bays. Several trophy size lake trout are still taken each year from both the summer and winter recreational fishery. The lake trout are angled during the open water season by trolling with large spoons or jigging with a variety of lures and bait. Offshore casting for lake trout occurs only at Pumphouse Point. The angling is concentrated in the shallow inshore areas in the spring and fall, and primarily in the deep areas during the summer months as the lake trout seek colder water. In more recent years, the use of echo sounders has significantly increased angler success during the summer months.

Winter angling is generally concentrated along the southern portion of the lake, likely due to access convenience rather than better angling. During the colder months, the majority of angling takes place from ice fishing shelters, however towards spring, angling pressure increases as shelters become unnecessary. The trout are angled by jigging, using baited hooks, bucktails or spoons.

Past records indicate that Clearwater Lake was commercially fished during the winter season from 1931 to 1944. Concern for the lake trout populations initiated the closing of this fishery in 1944. In recent years, several attempts have been made to utilize the whitefish captured in the trap-nets during the spawn taking operations, however logistical problems have hampeted the success of this commercial operation.

This study was conducted by the Fisheries Branch and was jointly funded by the Fisheries Branch and Parks Branch. Creel census staff were hired through the Student Temporary Employment Program (S.T.E.P.) administered by the Province of Manitoba.

MATERIALS AND METHODS

Creel Census - Summer

Data for this study were collected by means of angler surveys. Lake-side surveys were of a stationary nature where all anglers were interviewed upon completing a day's angling. Cottage owners were mailed forms complete with instructions and asked to compile data on their angling trips for the open water period. This portion of the census extended from the opening of the angling season on May 22 to October 21, 1983.

The three types of anglers sampled separately in this study were lodge guests, campground anglers and day use anglers. To account for variations in angling pressure between weekends and weekdays, the campgrounds and Pumphouse Point stations were further divided into two additional strata. It was assumed that lodges would not exhibit this variation.

For each of the angler types, a population of N days was divided into distinct strata for N_1, N_2 .....N_h days. Values of N for each station, stratum type, stratum sizes and sample size (N_h) are listed in Table 1. The minimum sample size within each stratum was three sampling days.

On each sampling day, as many angling parties as possible were interviewed. All remaining parties were counted to derive a total number of anglers utilizing the site for that sample day. In the case of lodges, census workers were free to select the lodge having the greatest number of anglers out for that day while maintaining a total count for the remaining lodges.

The following information was collected from each interviewed or intercepted angling party:

1. Number of anglers in party
2. Origin of angler
3. Species-specific angling effort (angler hours) and numbers of fish that were caught and released
4. Total number and weight of all fish retained by angling party, including shore lunch

The cottage owner forms were designed to gather the following information:

1. Date of angling
2. Number of anglers
3. Total hours fished by species
4. Number caught and retained by species

Table 1. Types and sizes of strata and number of sampling days for the creel survey stations during the open water and winter periods, Clearwater Lake, 1983-84.

Stratum Type	Stratum No.	N_h (days)	n_h (days)	Stratum Type	Stratum No.	N_h (days)	n_h (days)
Campgrounds				**Pumphouse**			
May weekend	1	6	2	May weekend	13	6	1
May weekday	2	11	1	May weekday	14	11	1
June weekend	3	8	3	June weekend	15	8	3
June weekday	4	22	3	June weekday	16	22	3
July weekend	5	10	3	July weekend	17	10	3
July weekday	6	21	3	July weekday	18	21	3
August weekend	7	9	3	August weekend	19	9	3
August weekday	8	22	3	August weekday	20	22	3
September weekend	9	9	3	September weekend	21	9	3
September weekday	10	21	3	September weekday	22	21	3
October weekend	11	11	3	October weekend	23	11	1
October weekday	12	20	1	October weekday	24	20	3
Lodges				**Winter**			
May	25	17	2	November weekday	1	14	2
June	26	30	6	November weekend	2	4	2
July	27	31	6	December weekday	3	21	4
August	28	31	6	December weekend	4	9	5
September	29	30	9	January weekday	5	22	5
October	30	31	6	January weekend	6	9	5
				February weekday	7	21	5
				February weekend	8	8	5
				March weekday	9	22	5
				March weekend	10	9	5
				April weekday	11	19	4
				April weekend	12	7	3

Cottage owners were asked to complete these forms for the entire open water season and return the forms. Upon completion of the open water angling season, intensive phone canvassing was conducted to secure more returns. Estimates of biomass harvest were calculated using data from the stationary census.

Creel Census - Winter

The winter census was conducted from November 1, 1983 to April 30, 1984. For this segment of the survey, the lake was treated as a single sampling area. Again, sampling strata were identified based on weekend and weekdays as well as monthly, resulting in a total of twelve strata. Each stratum was sampled a minimum of five days, selected at random prior to the census period. Values of N, stratum sizes and sample size are listed in Table 1.

Due to the nature of the winter fishery, the ease of travel and the excellent rapport maintained by the census worker with the anglers, it was possible to obtain total angling effort for each party as opposed to a roving creel census technique. The information collected was identical to that collected during the open water census.

Biological Sampling

Census workers attempted to sample as many fish as possible, subject to angler co-operation. Northern pike and lake trout were measured (fork length $\pm$ 1 mm) and weighed ($\pm$ 10 g). No ageing structures were collected from northern pike. Ages of lake trout were determined by examining thin sections of otoliths at 48x.

Length-weight relationships were determined from the following equation:

$$\log W = a + b (\log L)$$

where: W = round weight in grams

a = y - intercept

b = slope

L = fork length in millimeters

The condition factor (CF), which indicates a relative measure of robustness, was calculated for each fish from the formula:

$$CF = \text{Weight} \times 10^5/\text{Length}^3$$

RESULTS

Angler Interviews

A summary by angler origin for each area sampled is presented in Table 2. Non-residents comprised the majority of lodge anglers followed by resident Manitobans. The public access points (Pumphouse and campgrounds) exhibited similar results at each location with resident Manitobans representing the majority of anglers. However, very little non-resident angling occurs via the campground boat launches and these anglers appear to utilize the Pumphouse boat launch for access. In general, resident Canadians do not heavily utilize Clearwater Lake, comprising less than 15 percent at any of the areas sampled.

Table 2. Percent angler composition by origin for each area sampled in the creel census, Clearwater Lake, 1983 - 84.

Angler Origin	Area			
	Lodges	Pumphouse	Campground Access	Winter Census
Resident Manitoban	25.8	62.6	83.1	94.8
Resident Canadian	6.2	15.2	12.7	4.7
Non Resident	68.0	22.2	4.2	0.5

Results from the winter census indicate almost exclusive use by resident Manitobans with a small percentage of resident Canadians. Of the resident Manitoban use, it is known that the majority of this use is by local residents and, for the colder months, this represents a somewhat select group of individuals utilizing ice fishing shelters.

A summary of angler interviews and results from the cottage owners' survey is presented in Table 3. A total of 486 anglers were interviewed during the open water census and 403 during the winter census. Of the 349 cottage owner forms sent out, 77.4 percent were returned, representing 769 anglers. Of those forms returned, 46 percent indicated at least some angling took place from their cottage during the open water season. It should be noted that of the 124 cottages from which angling took place, 25 percent of those cottages accounted for 87 percent of the cottage harvest.

The data indicates lake trout are the preferred species. Pike are utilized to a somewhat lesser degree and primarily by lodges and cottages. In addition, many pike are taken as incidental catches while angling for trout. There are, however, a few locations on the lake offering excellent pike angling and these areas are used primarily by lodge guests.

Angling Effort

Stratified random estimates of daily angling effort for both weekend and weekday sampling days are illustrated in Figure 2. Differences in angling effort on weekend and weekdays varied for each area. At the Pumphouse, effort on weekdays was greater during the early season only. Conversely, at the two campground launches, effort on weekend days was greater during the early

Table 3. Summary of information pertaining to actual angler interviews from each sample area.

Area	Species	No. Caught	No. Released	No. Retained	No. Anglers
Lodges	Trout	107	19	88	84
	Pike	41	17	24	11
Pumphouse	Trout	111	14	97	208
	Pike	-	-	-	-
Campground Access	Trout	131	15	116	178
	Pike	8	1	7	5
Winter Census	Trout	534	0	534	403
	Pike	-	-	-	-
Cottages [a]	Trout	1131	133	998	769
	Pike	244	84	159	90

[a] numbers represent 77.4 percent of the total cottage harvest

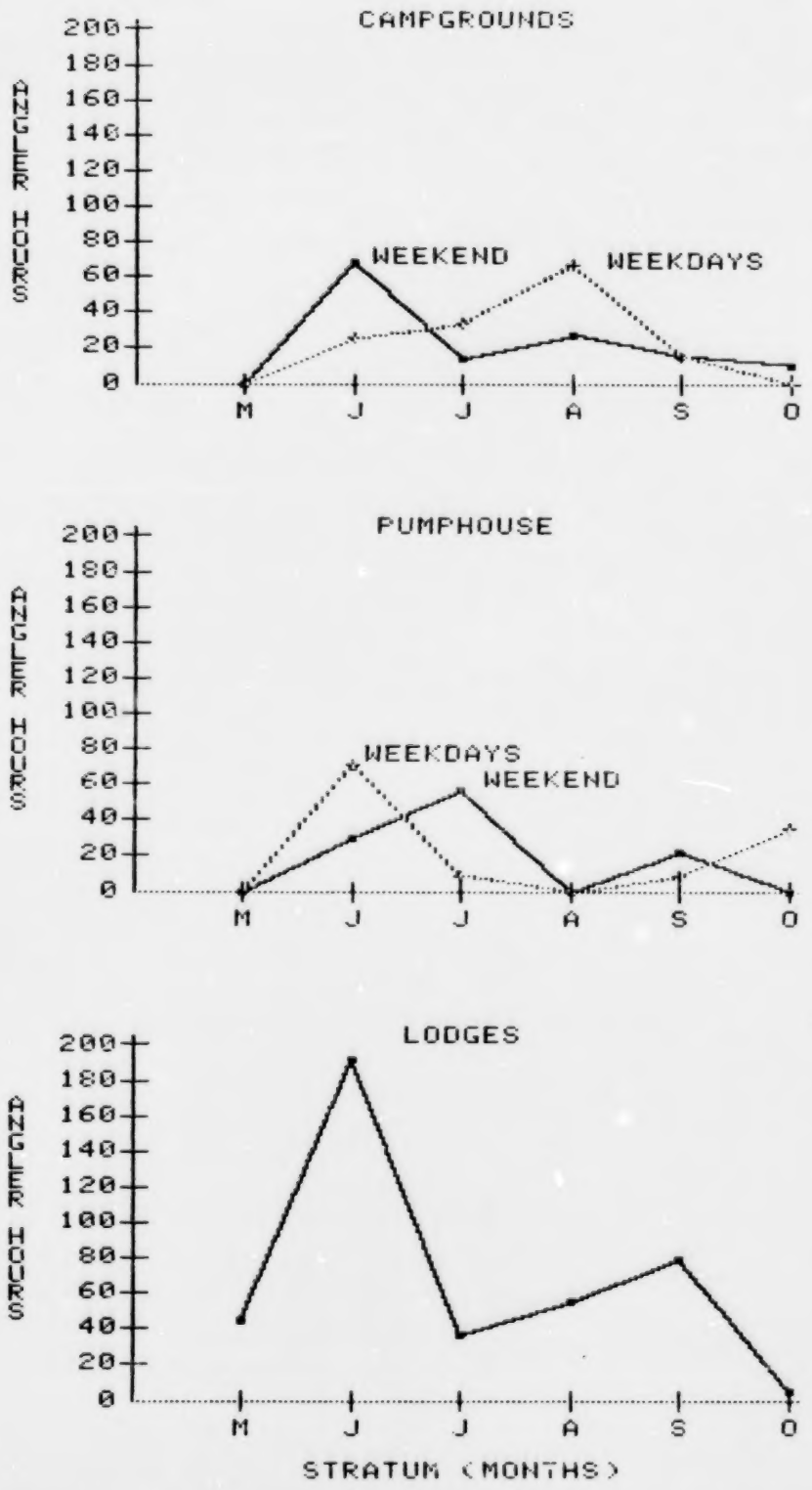


Figure 2. Stratified random estimates of daily angling effort during weekends and weekdays for the open water season.

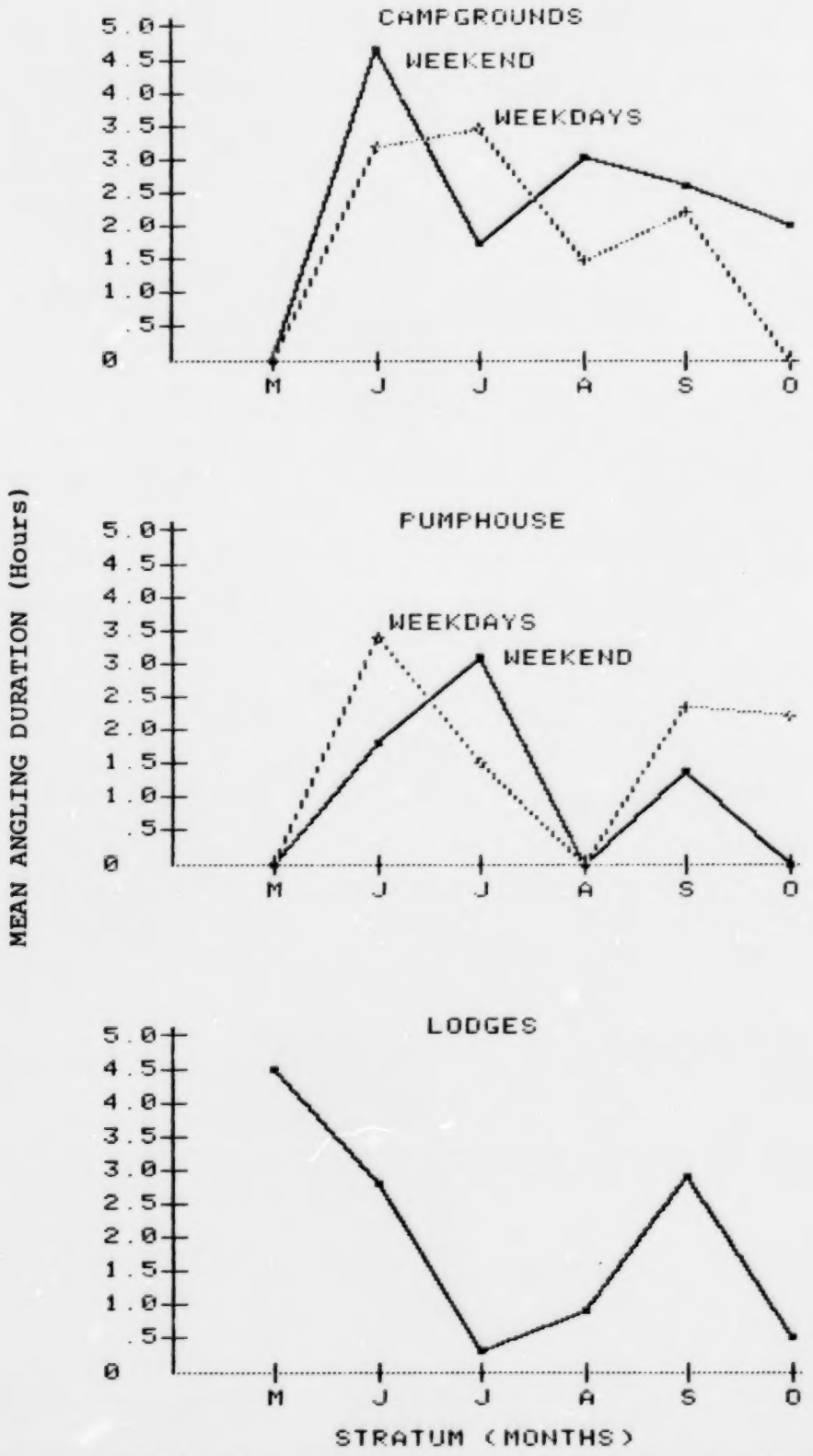
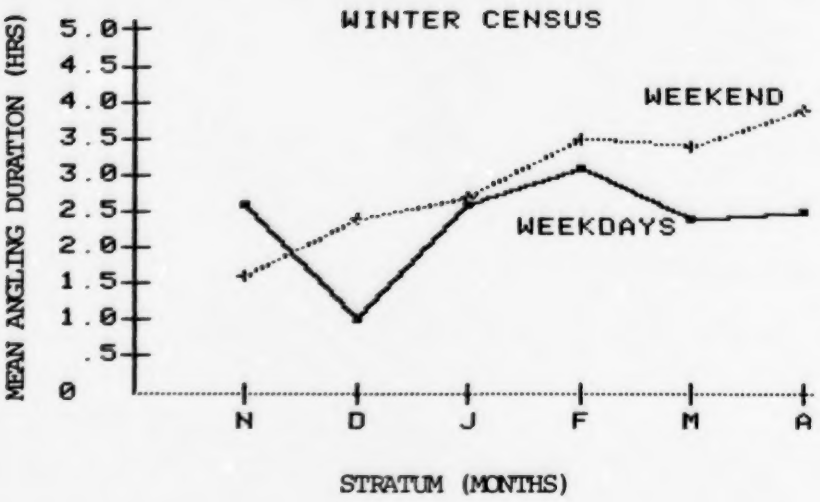


Figure 3. Stratified random estimates of mean angling duration during weekend and weekdays for the open water season.



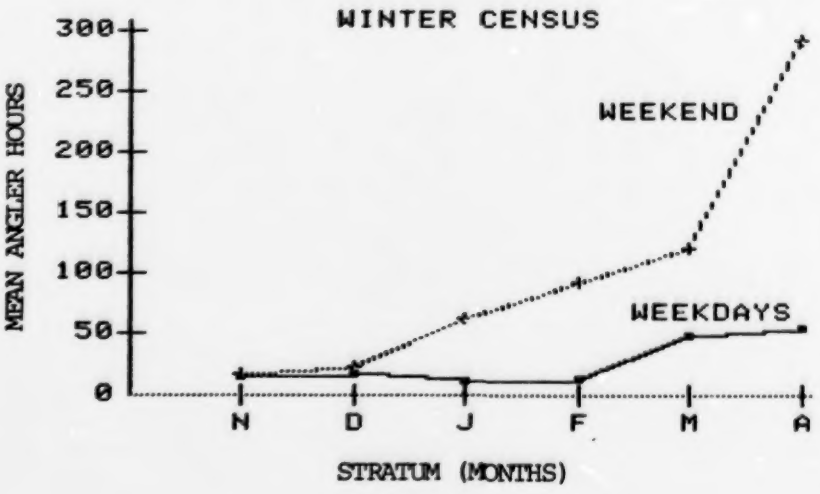


Figure 4. Stratified random estimates of mean angling duration and angling effort for the winter segment of the creel census.

season, followed by increased effort exerted on weekdays for the remainder of the season (Figure 2).

The mean angling duration, or daily effort per angler fluctuated throughout the open water season but generally exhibited higher values in spring and fall with reduced angling duration in mid summer (Figure 3).

In the winter season, angling effort on weekdays remained fairly constant and increased only in the latter part of the season. Weekend effort was consistently higher and steadily increased as the season progressed with a marked increase in April (Figure 4).

The mean daily angling duration during the winter season increased steadily for weekend days. Weekday values fluctuated widely with a marked decrease in December (Figure 4).

Harvest

Estimated mean daily weights of lake trout and northern pike harvested during the open water and winter census are illustrated in Figures 5 - 7. The harvest of trout was generally highest in June and lowest in the fall for areas sampled during the open water season. Pike harvest varied at each location but was highest during June. The campground and lodges show a marked increase in pike harvest in September. This is attributed to increased incidental catches of pike while angling in shallow water for trout. No data are available on monthly harvest rates for cottage owners during the open

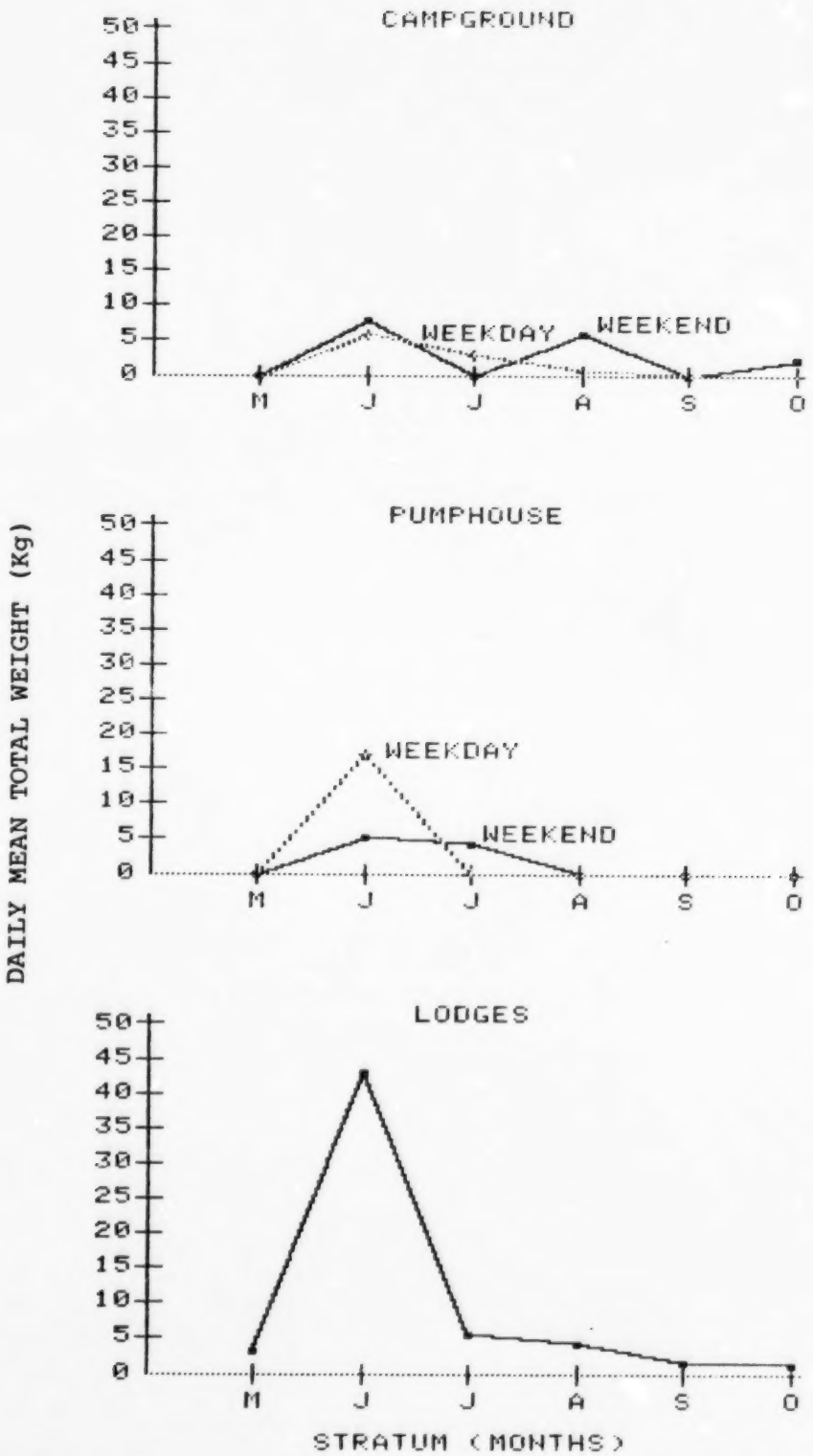


Figure 5. **Mean daily total weight of lake trout harvested at each location during the open water season.**

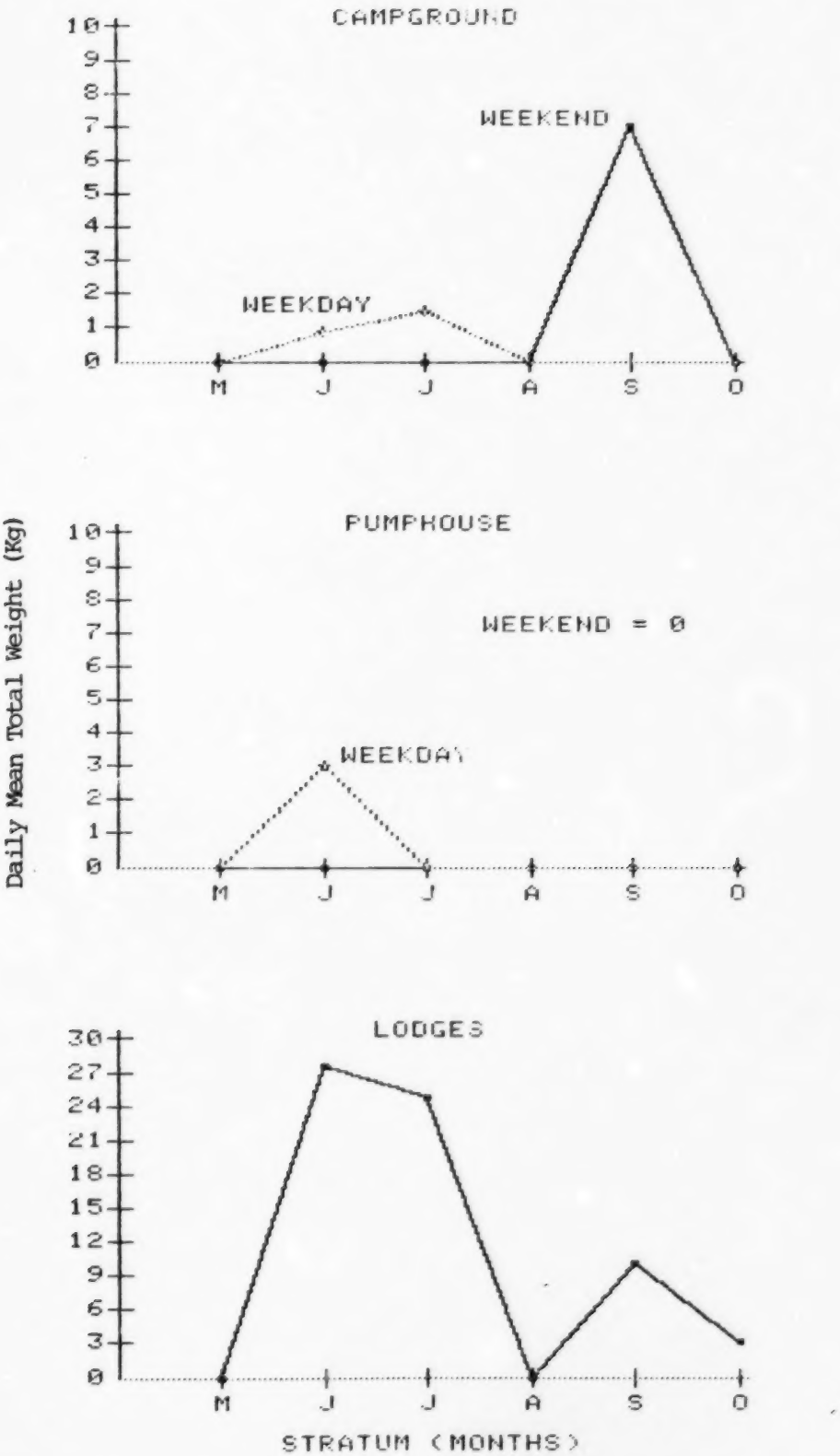


Figure 6. Mean daily total weight of pike harvested at each location during the open water season.

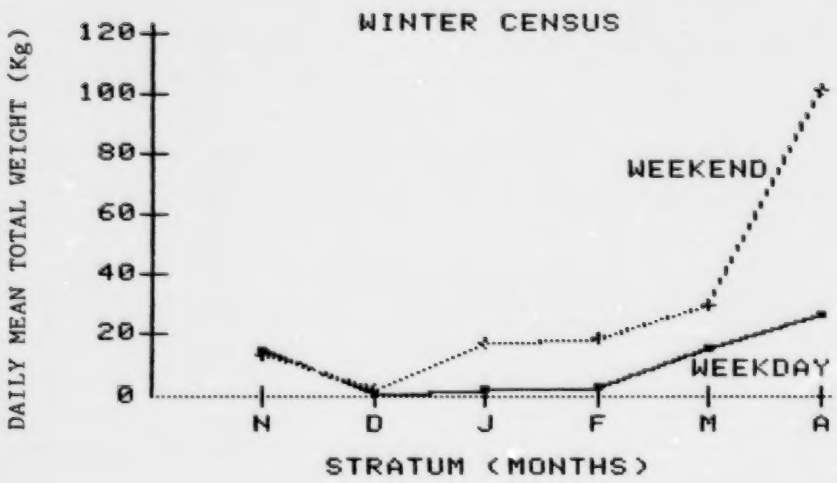


Figure 7. **Mean daily total weight of lake trout harvested at each location during the winter season.**

water season. Winter harvest of trout remained fairly constant throughout the winter but increased sharply in March and April. No northern pike were harvested during the winter season.

The total harvest of each species for the entire census period is summarized in Table 4. Lodges accounted for the highest harvest values for both pike and trout. The winter values exhibited the second highest harvest. The total annual harvest from Clearwater was estimated at 11,060 kilograms of trout and 2,775 kilograms of northern pike.

A summary of the estimated number of fish landed, percent released and catch per unit effort is presented in Table 5. The percent of trout released ranged from 0 in the winter to 17.7 in the open water season. The percent of pike released was higher, ranging from 12.5 to 41.5 during the open water season. Catch per unit effort values ranged from 0.10 fish per hour for campground users to a high of 0.55 fish per hour for cottage owners. The average catch per unit effort was 0.25 fish per hour. No catch per unit effort data by species could be calculated due to the census design.

Biological Sampling

Results of the biological sampling for lake trout are summarized in Table 6. The mean size of the anglers' catch of trout was 512 mm fork length and 1.65 kg round weight (N = 176).

The age-frequency distribution and catch curve for lake trout are illustrated in Figure 8. Ages ranged from 5 to 24 with a distribution heavily skewed to the left. The mean age was 10.8 years.

Table 4. Estimated harvest of lake trout and northern pike based on creel census data from Clearwater Lake, 1983-84.

Strata	Species	Number Retained	95% Confidence Interval	Total Weight (kg)	95% Confidence Interval
Lodges	L. Trout	2,825	±256.1	5,176	±474.2
	N. Pike	685	± 46.2	2,049	±135.2
Campgrounds	L. Trout	330	± 34.4	542	± 63.7
	N. Pike	46	± 5.6	113	± 13.6
Pumphouse	L. Trout	454	± 45.9	780	± 84.1
	N. Pike	22	± 6.7	67	± 20.5
Winter	L. Trout	1,629	± 29.1	2,507	±477.2
	N. Pike	-	-	-	-
Cottages	L. Trout	1,223[a]	-	2,055[b]	-
	N. Pike	195[a]	-	546[b]	-
Totals	L. Trout	6,461	-	11,060	-
	N. Pike	948	-	2,775	-

[a]Estimated numbers based on 77.4% return of mailout forms

[b]Estimated weight based on mean weight from creel census

Table 5. Summary of estimated fish landed and catch per unit effort data based on actual creel interviews and estimated harvest data.

Area	Lake Trout			Northern Pike			Total		Fish/Angler Hr
	% Released	No. Retained[a]	Total Landed[b]	% Released	No. Retained[a]	Total Landed[b]	No. Angled	Effort (Hrs)	All Species
Lodges	17.7	2,825	3,305	41.5	684	968	4,273	16,447	0.26
Campground	11.4	330	367	12.5	46	51	418	4,234	0.10
Pumphouse	12.6	454	511	-	22	22	533	3,612	0.15
Cottages	11.8	1,223	1,367	34.4	195	302	1,669	3,059	0.55
Winter	0	1,629	1,629	-	-	-	1,629	7,892	0.21

[a]Estimated number retained from creel census and cottage survey

[b]Percent of released fish added to estimated number retained

Table 6. Mean fork length, mean round weight and mean condition factor by age for lake trout from the anglers' creel, Clearwater Lake, 1983-84.

Age (Yr)	No.	Fork Length (mm) Mean	Fork Length (mm) SD	Weight (g) Mean	Weight (g) SD	Condition Factor
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	5	391	40.2	688	274.8	1.11
6	16	424	37.3	915	304.1	1.16
7	23	464	35.8	1151	292.3	1.13
8	20	490	32.2	1409	335.0	1.18
9	27	508	20.3	1526	202.3	1.16
10	17	531	28.6	1741	235.8	1.16
11	7	567	57.0	2204	525.5	1.20
12	6	545	68.0	2393	1604.3	1.34
13	7	566	19.3	2301	337.2	1.27
14	11	543	28.4	1960	335.0	1.22
15	13	563	33.7	2027	364.7	1.13
16	5	547	34.4	1898	413.7	1.15
17	6	575	26.9	2153	307.0	1.13
18	1	506	0	1690	0	1.30
19	3	560	45.0	2050	645.8	1.14
20	3	569	57.2	2053	405.0	1.12
21	1	631	0	2320	0	.92
22	1	580	0	2130	0	1.09
23	2	628	137.9	3225	2298.1	1.17
24	2	587	89.1	3175	1873.8	1.46
Total	176					
Mean	10.8[a]	512	62.1	1654	683.8	1.17

[a]indicates mean age

Length-weight regression

Slope: 3.13829919

Y-intercept: -12.2230082

Correlation co efficient: .964522399

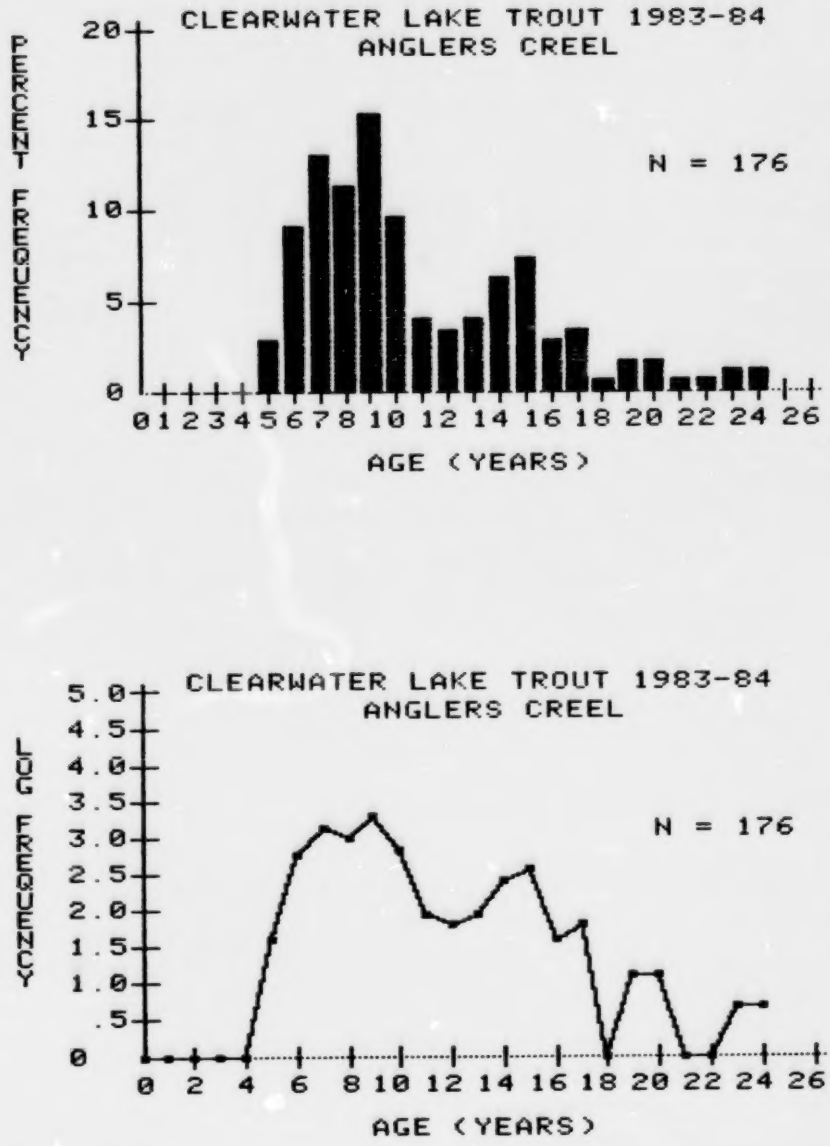


Figure 8. Age-frequency distribution and catch curve for lake trout sampled from the anglers' creel, Clearwater Lake, 1983-84.

The catch of northern pike during the census was small, resulting in a sample size of only 47. No ageing structures were collected. The mean fork length of the anglers' catch was 702 mm (range 538 - 1003 mm). The mean weight was 2,798 g (range 1,100 - 8,720 g).

DISCUSSION

The weak point in any creel census lies in the estimates of total daily effort. Many anglers interviewed merely provide a guess of their angling hours. If it is assumed that anglers tend to over estimate values, then extrapolated results would be higher. However, it is likely that the effect is minimal on the overall estimates of effort.

The census failed to adequately identify all user groups and their portion of the total effort and harvest. This was due to errors in sample design resulting from an inadequate knowledge of the fishery. Anglers interchangeably utilized various access points, depending on wind direction and lake area fished. This created unexpected problems for census workers attempting to sample a particular group. Local day users were undifferentiated in the census, particularly at the campground launches. Campers were undifferentiated at all three sample sites.

Although not separately identified in the census, the local and camper harvest and effort are included in the campground and Pumphouse estimates. The estimates for winter and lodge harvest are considered reliable.

The data indicated seasonal fluctuations in weekday versus weekend effort for each group sampled with the exception of lodges. It was expected that weekend effort would be consistently higher such as was evident in the winter season. This is likely due to the lack of differentiation between user groups, particularly local users.

The statistical criteria for the census were met, however in many cases, only the three days per month were sampled for a particular stratum in the open water season. Increased staff would alleviate this problem and provide more accurate results. Post-census discussions with lodge owners indicated that census workers repeatedly missed periods of heavy angler use merely as a result of sample design and scheduling. This may have resulted in under-estimates of lodge harvest.

There is a direct negative relationship between wind velocity and effort on Clearwater Lake in the open water season. Due to the physical shape of Clearwater Lake and the location of fishing areas, winds approximating 20 km/hr will, in most cases, keep anglers off the lake. The direction of the wind is not usually a factor in this observation. Daily wind velocity data indicated that 38 percent of the days from May to September, 1983, exceeded 20 km/hr (Regional Services, Fire Management data).

As a single group, lodges exerted the greatest amount of effort. Total effort from the three lodges was estimated at 16,447 hours during the open water season. However, the census did not clearly delineate all user groups. Local residents were included in the campground and pumphouse strata and also comprise a high percentage of cottage users. As a result, the census

would indicate that local residents exert a significant portion of the effort during the open water season. On an annual basis, local residents exert an effort nearly equal to that of the lodge use.

Catch per unit effort values indicated that cottage owners experience the greatest angling success. However, many cottage owners merely estimated total seasonal catch and effort rather than daily estimates. This may have resulted in over estimates. In addition, a small select group of cottage owners represented a large portion of the angling effort, thus indicating that cottage owners who do fish regularly are highly successful. Their success is likely attributed to experience and accessibility specific to Clearwater Lake.

Lodge catch per unit effort values were second only to cottage owners. Their success can be attributed to the use of guides and the fact that as a group, they are likely more dedicated fishermen. Winter angling has been steadily increasing in recent years and now represents a significant portion of the total angling effort. Catch per unit effort data for winter angling indicates that winter anglers are nearly as successful as lodge guests. There is no indication that this segment of the angling effort will not continue to increase in the future.

The overall catch per unit effort for Clearwater Lake is 0.25 fish per angler hour (Table 4). Information collected primarily in southeast Manitoba indicated that a catch per unit effort of between 0.25 - 0.50 fish per angler hour represented minimum angling quality. These data were gathered on primarily pike and walleye based fisheries. It is reasonable to assume that angler expectations on a road accessible lake trout fishery would be lower.

However, when compared to other lake trout fisheries, Clearwater Lake exhibits comparatively low catch per unit effort values. Anglers on Great Bear and Great Slave Lakes caught between 0.37 - 1.76 fish per angler hour (Moshenko and Gillman, 1978). Neultin Lake data yielded a range of 0.80 - 1.57 fish per angler hour (Degraff, unpublished).

In addition to comparing rather poorly with some well known trout waters, there are indications of a marked decline in catch rates on Clearwater Lake. Historical data on file indicates a mean fish per angler hour value of 0.76 based on Resource Officer patrols and interviews for the open water season of 1959.

The above catch per angler hour information indicates that Clearwater Lake has been heavily utilized. While the trout stocks have remained biologically viable, the angling quality has reached a level where it is now a source of concern if angler expectations are to be satisfied. Maintaining or improving angling quality can only be attained through additional control of harvest levels.

The mean length, weight and age for lake trout from the anglers' creel were only slightly lower than those values reported in the lake trout stock assessment study (Leroux, 1983). The assessment study indicated trout stocks were healthy but that older, larger fish were poorly represented in the population. It is apparent that anglers are primarily consumptive in nature and are non-selective in the retained catch. This is confirmed further by the low percentage of released trout (range 0 - 17%) which falls far below the provincial average of 44% for angled lake trout (1980 Sport Fishing Survey).

The sample size of northern pike was small (N = 47) and did not warrant analysis. However, a mean fork length of 702 mm and a mean round weight of 2.80 kg indicates that anglers are selective for larger pike. In addition, the census indicated that the lodges account for 74 percent of the pike harvest. Anglers do not appear to angle for pike in the winter season and much of the remaining pike harvest by resident anglers can be attributed to incidental catches while angling for lake trout.

The maximum sustainable yield (Ryder, 1965) for Clearwater Lake is calculated at 140,328 kg annually. Based on representative biomass from netting data, an annual yield of 22,000 kg of lake trout was estimated (Leroux, 1983). Healey (1978) examined data from North America and concluded that yields of trout are not sustainable when harvests exceed 0.5 kg/ha. Healey's maximum yield for lake trout from Clearwater, using this figure, would be 14,400 kg annually.

The estimated harvest of lake trout from the census (11,060 kg) is likely an under-estimate. Discussions with staff, lodge operators and others involved in the fishery indicated that angler success during the census year was generally poor due, in part, to weather conditions and other unknown factors. In addition, the harvest of trout is commonly known to increase in the fall as trout move up into shallow water and become more susceptible to angling. The census failed to show this harvest. Thus, annual angler harvest from Clearwater Lake is likely higher than the census indicated and would fall even closer to the reported MSY values for trout.

The estimated harvest of northern pike appears reasonable (2,700 kg) recognizing that a majority of anglers are only interested in lake trout and that Clearwater Lake is a deep, oligotrophic lake and does not support a large pike population. Pike habitat is restricted to a limited amount of shoreline and a few shallow bays.

The pike fishery is used primarily by lodges and although small in magnitude, the angling quality is good. Catches in excess of 7.0 kg are not uncommon in some key areas. In view of the nature of the lake, any increase in harvest levels would result in a decline in angling quality.

SUMMARY

1. Annual harvest of lake trout and northern pike were estimated at 11,060 kg and 2,775 kg respectively. Clearwater Lake is primarily a single species fishery and the current harvest levels are approaching the MSY.

2. Lodges account for 47% of the trout harvest and 74% of the pike harvest. Cottage owners account for 18% of the trout harvest and 19% of the pike harvest. Winter harvest of trout accounts for 23% of the harvest. The remaining harvest is taken by campground and local day users.

3. All angler groups are consumptive in nature and release rates fall well below provincial averages.

4. Catch per unit effort is low in comparison to other lake trout fisheries and appears to have declined.

5. Angling pressure is highest in June, July, September, March and April.

6. Non-resident use is highest at the lodges. Non-resident Canadian use is minimal. Winter use is almost exclusively resident Manitobans.

7. Weather has a strong influence on angler use during the open water season. Its open exposure makes it highly susceptible to wind.

8. A small proportion of the cottage owners account for a high percentage of the cottage harvest.

MANAGEMENT IMPLICATIONS

The study indicated that harvest levels for trout and pike were near the maximum sustainable yield and that angling success has declined. In contrast, the number of resource users is comparatively large and is likely to increase in future years.

Generally stated, the objectives for the Clearwater Lake fishery are to maintain the biological viability of fish stocks in order to meet the recreational needs of anglers and to maximize the economic return to existing commercial operators.

Although specific information regarding angler expectations is lacking, it is reasonable to assume that most anglers want to maintain or enhance the current angling quality. As the demand on Clearwater Lake fish resources will continue to increase, anglers must be prepared to accept a reduction in current

harvest levels to meet this expectation. This reduction can be more readily accepted by ensuring that angling opportunities are maintained or enhanced through catch and release angling. This approach would be consistent with provincial objectives relative to sport fishing.

The available options for management have been reviewed on the basis that harvest levels must be reduced in order to maintain angling quality and that angling opportunities must be maintained or enhanced where possible.

1. Area and Seasonal Closures

Additional area or seasonal closures would reduce harvest, however would also reduce angling opportunity. The present west shore closure in the fall is effective for protecting spawning trout and should be maintained. It is socially acceptable even though it does reduce opportunity to some degree. The general closure in spring has minimal effect on Clearwater Lake as ice usually prevails until late May and is not safe for ice fishing.

To be effective, additional closures would minimize opportunity at the periods when anglers are most successful. Closures of this type create the most social disruption and are the least acceptable as they will restrict mainly resident anglers who have a high priority for the resource use.

2. Reduced Limits

A reduction from the present limit of three trout would have minimal effect as the mean catch was 1.65 fish per angler day. In addition, trout have the lowest limit in the province and any reduction would be socially unacceptable to most resident users. Lodges on Clearwater cater primarily to fly

limit anglers, particularly when trophy angling is not readily available. Any reduction would likely have a detrimental effect on the lodges.

3. Gear Restrictions

Gear restrictions are usually aimed at reducing angling effectiveness thus reducing harvest. Following this strategy will be in direct conflict with present Branch policy of maximizing angler opportunity. The prohibition of echo sounders has been suggested and falls into this category. It has been clearly demonstrated that the use of this equipment is very effective in locating trout and enhancing the ability to catch them. This increased angling satisfaction is desirable from a Branch perspective and would be possible through catch and release angling. In addition, the prohibition of echo sounders would create enforcement difficulties as they are recognized as safety equipment for boating.

4. Size Limits

Minimum size limits are not necessary as studies on the lake trout population in Clearwater Lake indicate that recruitment is not a problem.

Slot limits would reduce harvest, however are not recommended for several reasons. Slot limits would likely be established in the size range which presently represents a majority of the trout caught. This would be unacceptable to most user groups. Secondly, while total trout harvest would be reduced, the harvest of larger sized trout would likely be increased. In the long term, this would decrease the angling quality as larger, more desirable

trout become scarce. Finally, slot limit regulations are new in this province and have only recently been implemented. There is little information available on the effects on cold water species with slow growth rates.

5. Individual Annual Limits

This strategy would see the implementation of an annual limit per angler to be controlled through issuing a set number of tags per angler per year. As a trout is harvested, the angler would be required to invalidate a tag and attach it to the fish.

This system would be difficult to implement administratively, however several benefits can be realized.

1. No decrease in angling opportunity
2. Effectively controls harvest
3. Easily enforced
4. Promotes catch and release angling
5. Allows for consideration of additional fishery based development thus removing the need to manage by controlling development

The system would have to be implemented for all user groups to be equitable and enforceable. It is recommended that an annual maximum of six tags per angler be issued while lodges could be assigned a fixed number of tags for distribution to guests at the operator's discretion.

The present rate of exploitation on trout is keeping recruitment to the larger size and age classes to a minimum. It is unlikely that trout stocks would ever recover to a trophy status without the implementation of rigid harvest restrictions over a lengthy period of time. However, the potential to catch a large trout is an important factor in maintaining the angling experience as well as the reputation of Clearwater Lake. Consideration should be given toward additional protection for large trout in order to ensure the opportunity to catch a trophy trout is maintained on this fishery.

The maintenance of the small but high quality pike fishery is of some value to the lodge industry. There are a limited number of guests who specifically angle for pike on Clearwater Lake while others utilize pike as a break from trout fishing. Current regulations are sufficient to maintain the angling quality, particularly if catch and release angling is practiced. Future regulations should continue to protect this trophy resource and lodges should be encouraged to promote catch and release angling on this limited resource.

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